How To Properly Conduct Field Trials

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INTRODUCTION

Conducting a proper field trial is not an easy task. If trials are not properly conducted, the questions that were supposed to be answered cannot be answered. In some cases, it may even lead to the wrong conclusions. In both cases, time and resources spent conducting the trials could have been better spent. On the other hand, properly conducted trials can be very effective in answering important questions that are unique to individual pork production units. They can yield good information that can have substantial impacts on future animal and financial performance.

POINTS TO CONSIDER

Many important points should be considered before the trial is even started, and during the trial:

1) State the objectives for the trial. What are the questions that you want to answer? A clear statement of objectives will tell you what treatments to evaluate, what kind of observations to make, and how many observations you have to make.

Keep the objective (and design of the trial) as simple as possible. If you try to answer too many questions at the same time, you will probably answer none of them properly.

Also discuss what you consider to be a meaningful (significant) difference in pig performance between treatments. In other words, what kind of a difference between treatments do you need to observe before you act on the results of the trial ?

2) Choice of treatments. Only the variable that you want to evaluate (feed, feeders, medication, pig
[geno-] types) should be varied between treatment groups. If you conduct trials to determine the optimum levels of nutrients (protein, amino acids, phosphorus, etc.) or of medications in diets for your pigs, carefully choose the target nutrient levels in your diet.

3) Control of all other factors. All other factors that may affect pig performance (environment, feed, feed form, feeders, medication, pig [geno-] types, sex, litters, initial body weight, health, general quality of pigs, pig density, floor type, water supply) should be kept constant across treatments. It does not make sense to compare two feeds when these two feeds are used in separate pens, rooms or barns that result already in differences in pig performance.

Whenever possible, treatments should be compared within units where pig performance is relatively constant (compare treatments within a room or barn,

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within pig [geno-] types, within litters, and balance for initial body weights).

4) Identify the experimental unit. More often than not a pen of pigs is the experimental unit on which observations (feed intake, feed:gain) are made: comparisons are made between pens of pigs, and not between individual pigs in one pen and individual pigs in another pen. If feed usage can only be determined for an entire room (or barn), then the entire room (or barn) becomes the experimental unit for calculating feed intake and feed:gain. The size of the experimental unit has consequences for how many observations you need to make and how many animals you need per treatment.

5) Estimate the (minimum) number of observations per treatment. The number of observations (pigs, pens, experimental units) per treatment is determined by the (size of the) difference that you want to identify between treatment means. It is also determined by the normal variation that you see between pigs within and between pens (or rooms or barns). For example, normal variation in growth rates in groups of pigs on well-run commercial farms is approximately 10%, and it may vary from 5 % to well over 15 % (Figures 1 and 2).

Performance over short time periods is also much more variable than that observed over longer time periods. To properly evaluate growth rates, growth should probably be determined over at least 2 weeks in the hot nursery. This may increase to at least 4 weeks when pigs approach market weight. For estimating feed intakes these periods may be shortened, probably by 50%.

Simply due to normal variation in pig performance, and due to good or bad luck, differences in growth rates between pens of pigs can easily be 5 %. This can occur, even if all conditions (environment, feed, pig [geno-)] type, sex) appear exactly the same in the two pens of pigs. In order to get meaningful (significant) differences between your treatments, you need more than one observation per treatment. If you increase the number of observations, you can increase the level of confidence that the observed means are accurate. In Table I, the number of pigs required to show that an observed difference of 3 %, 5 %, 10% or 15 % in average growth rates between two treatments are meaningful, are summarized. It clearly demonstrates that the required number of pigs increases dramatically if you want to accurately detect small but meaningful differences. A difference in performance of 3 % may not seem very much, but if you look at long term economics it can have a big impact on the bottom line.

Table 1. The number of pigs required per treatment to make sure that differences in average growth rates between treatments are real and not just due to good or bad luck*.

Chance of getting the correct answer	9 out of 10 times	19 out of 20 times
Chance of getting the wrong answer	1 out of 10 times	1 out of 20 times
Difference between treatments that you might consider meaningful:	Number of pigs required per treatment	
15%**	6 pigs	8 pigs
10%**	14 pigs	17 pigs
5%**	53 pigs	67 pigs
3%**	146 pigs	184 pigs

* Assuming 15 % variation in growth rates within groups of pigs.

**If the average growth rate is 700 g/d, then these % differences represent differences in growth rates between treatment averages of 105 g/d, 70 g/d, 35 g/d, and 21 g/d, respectively.

For conducting sow trials, consider this: given normal variation in litter size, you probably need observations on 50 litters per treatment to show that an observed difference of one pig per litter between treatment means is significant.

6) Randomize treatments. Make sure that the pigs or pens on the various treatments are spread throughout the whole room or barn. We all know that there are differences in performance between pens and pigs depending on their location (inside vs outside walls, end pens vs centre pens, pens close to the door vs others, etc.)

7) Evaluate all treatments at the same time. Simply due to changes in weather, (small) changes in health status, attitude of the stock person and many other factors, pig performance is not constant over time.

8) Keep accurate records. Continuously monitor what is going on. It should be confirmed that the treatments are indeed what you think they are (in feed trials sample feeds and submit them for analyses; take at least 5 different sub-samples at various times during the trial; mix them and send the composite sample to the lab). Also, check that all other factors are indeed the same for all pigs on all treatments. Keep a note book handy to write down your regular observations (pig or pen identification; what pigs/pens are on what treatments; pig weights and feed usage on various dates) and any abnormalities (sick pigs; date and weight of pigs that are removed; dirty feed that is removed from feeders; later when you calculate the results they may come in handy when you have to explain some abnormal values). Weigh all pigs (and feeds) on all treatments at the same time and check the accuracy of your scales at each weighing. Example data collection sheets are included in this write-up.

9) Properly calculate and interpret the results. Common calculations include:

Total feed usage (kg per pen, kg per treatment) = (feed in feeders at the start of the trial; kg) + (all feed added during the trial; kg) - (feed in feeders at the end of the trial; kg).

Total pig days (per pen or treatment) = (number of pigs per pen or treatment) x (number of days on trial).

If some pigs are removed from the trial before the end (sick pigs, very fast growing pigs), then the number of pig days may have to be calculated for every individual pig on test. These should be added up for all pigs that were started in each pen or treatment when the trial is completed.

Total pig weight gained (kg per pig, kg per pen, kg per treatment) = (total weight at the end of the trial [per pig, per pen, per treatment]; kg) - (total weight at the beginning of the trial [per pig, per pen, per treatment]; kg).

Don't forget to include the weights of pigs that are removed during the experiment.

Feed : gain = (total feed usage; kg) / (total weight gained; kg)

Feed intake (kg per pig and per day) = (total feed usage; kg) / (total pig days)

Growth rate (kg per pig and per day) = (total pig weight gained; kg) / (total pig days)

Feed : gain can then also be calculated as:

Feed : gain = (feed intake per pig and per day; kg) / (growth rate per pig and per day; kg)

Feed cost ($ per kg of gain) = (cost of feed; $ per kg) x (feed : gain)

Margin over feed costs ($ per kg of gain) = (value of gain; $ per kg of gain) - (feed cost; $ per kg of gain)

The value of gain could be the weaner pig price ($ per kg of live weight) for starter pigs, or can be calculated from the bid price per kg of carcass for grower-finisher pigs:

Value of gain ($ per kg of gain) = (Bid price; $ per kg of carcass) x (average carcass index / 100) x (dressing % / 100)

Margin over feed cost per pig and per day ($ per day) (margin over feed cost; $ per kg of gain) x (growth rate; kg per day)

The last calculation not only values the profit that you make per pig. It also values throughput, i.e. the value per pig place per day or year.

If at all possible, calculate variation in performance within treatment and compare this to observed differences between treatments (Figure 2). An increasing number of service people or consultants can help you in properly analysing your results and help you draw the right conclusions.

Observed variations in growth rates are becoming increasingly important. If we use expensive facilities and/or all in-all out production systems, it is important that space is used efficiently. The major reason for an inefficient use of space is variation in growth rates within groups of pigs. Throughput is not determined by growth rates of the average pig, but by growth rates of slowest pigs in the group. Alternative management practices, including feeding programs, that reduce variation in growth, may be more expensive to implement. However, if it results in a more efficient use of space they can enhance profitability. Therefore, consider monitoring and interpreting not only average pig performance but also variation in pig performance when conducting on-farm trials.

CONCLUSIONS / FINAL NOTES

1) Conducting a good field trial is difficult. Even the professionals (researchers) make mistakes, try to cut corners, and are sometimes (or often ??) unable to answer the questions they set out to answer. Carefully plan the trial before you start.

2) Consider developing and using a simple system to continuously monitor performance and minimize the number of on-farm trials. The value and use of a product is best demonstrated if performance is continuously monitored and adjustments are made continuously.

3) Consider working with a consultant or supplier (of feed, equipment, service) and use their expertise to improve performance in your herds. This is often much more effective than comparing product A vs product B and using what appears the best of the two. In fact, neither product A nor product B may be the most suitable product for you.

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